Integration Building Blocks for Sensors and Systems – Digital Critical Infrastructure

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Outline

- **Introduction**
- **Relevancy**
- **Digital Critical Infrastructure (DCI)**
- **The Need for Common Components**
- **Issues**
- **Recommendations**
- **SensorView™**
- **Benefits**

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Why am I Here?

- **I am supposed to present something that is hopefully relevant to this community.**
- **I am going to do that by focusing on the applied applications of systems and the current issues that exist with many of these systems.**
- **I believe I can best fulfill the mission of this presentation by providing context relevant to a particular set of technical issues and then our recommendations on how to address them.**
- **It all starts here… ultimately promoting a common set of building blocks for all phases… from conception to product fielding.**

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Why am I Here?

- My company (RTI) and myself have extensive experience in:
  - Successful mission critical software development for the U.S. Department of Defense since 1992
  - CBRNE sensor integration
  - Network and data management
  - Relevant hands-on lessons learned of current CBRNE systems
- We have a future perspective based on our COTS SensorView (www.sensorview.com) product suite and a keen and unique insight into the problems that exist currently that need to be addressed
- I will focus on issues and recommendation, with an overview of technical specifics to the extent necessary to provide context for those issues and recommendations

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Why Credible? Experience.

- **Incorporated in 1992**
- **Headquartered in Fairfax, VA**
- **Expertise in mission critical embedded and distributed systems for government and private entities**
- **Customers Include: Soldier, Biological, and Chemical Command (SBCCOM), Joint Program Office for Biological Defense (JPO-BD), Lockheed Martin, Motorola, ExxonMobil, Alenia Marconi, Logistics Management Institute**
- **Board of Advisors: Larry Blue, Thomas Hewitt, Don Upson, Daniel Young, Lenny Izzo (FY 2002 Only)**

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Why Credible? Performance.

- **Joint Biological Point Detection System (JBPDS)**
- **Multi-Purpose Integrated Chemical Agent Detector (MICAD)**
- **Biological Aerosol Warning System (BAWS 97/98)**
- **Biological Agent Warning System (BAWS III)**
- **SensorView™ (SV)**
- **Automated Carrier Quality Control System (ACQCS)**
- **Joint Warning and Reporting Network (JWARN) Prototyping**
- **Joint Service Installation Pilot Program (JSIPP)**

MICAD

BAWS III

SV

BAWS 97/98

JBPDS

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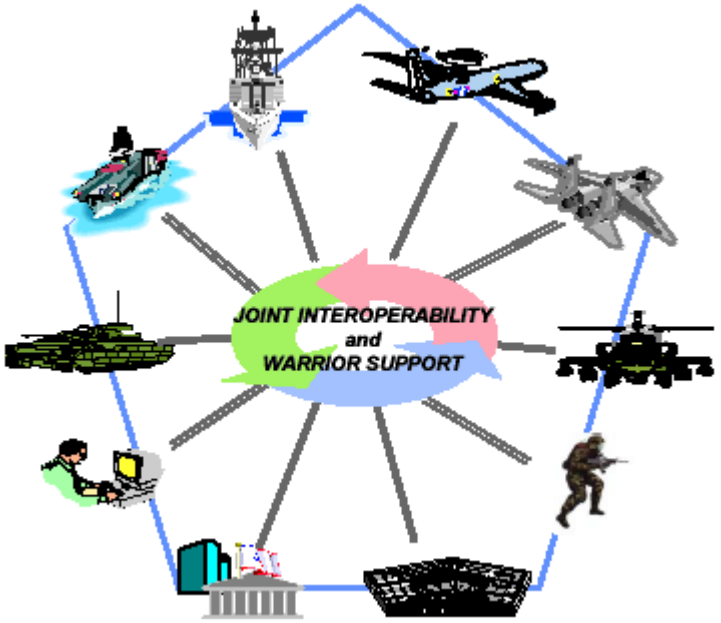
Why Relevant?

- Network-Centric Computing
- Secure Plug-n-Play (SPnP)*
- Standardization
- Standard Architectures (e.g. Joint Technical Architecture (JTA))
- Interoperability
- Move to COTS and Efficient Performance Based Acquisition
- All of the systems on the previous slide have different computer cores, communications technologies, protocols, software and hardware support and logistics environments and requirements, but they DO NOT HAVE TO!!!



SPnP is a very specific PnP methodology created by RTI for the purpose of allowing flexibility in device configuration, but not at the cost of security.

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Why Relevant?

- We are on an ever-increasing path in technology that calls for:
  - Miniaturization, reduced power requirements, mobility, dynamic environments, low cost highly reliable computers, interoperable communication infrastructures, sensors and mobile devices.
- These systems will need to share / access the same data repositories, computing resources and goals, and usually involve human monitoring, guidance and control. These systems will become increasingly interdependent and the amount of data provided will increase to the point that more intelligent and accurate common automated processing and guidance will be an ever-increasing requirement.
- Applications involve distributed monitoring, battlefield management, disaster response, enterprise-wide distributed agent systems, self-healing networks, of e-commerce, and surveillance systems.
- **The goal is to make this technology available affordably and dependably to ultimately lower the risk to end users (scientists, medical, war fighters, first responders, etc.) by creating a transparent Digital Critical Infrastructure (DCI)**

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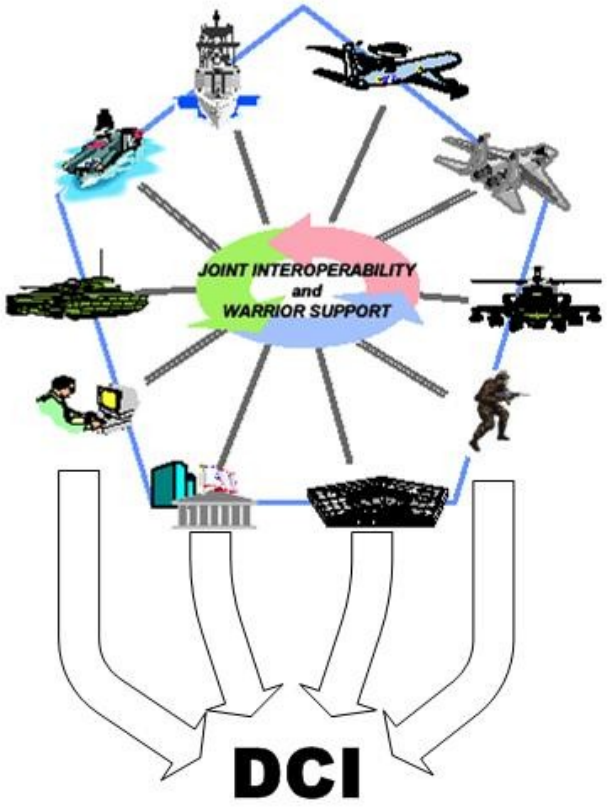
Digital Critical Infrastructure*

- **What is it?**
  - **Information Technology Facilities**
  - **Networks**
  - **Communication Services**
  - **Databases**
  - **Interfaces**
  - **Protocols**



"Digital Critical Infrastructure (DCI)" is a term coined by RTI for the purpose of describing **any computing or data component critical to maintaining constant situational awareness and command and control of a given environment.**

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DCI Requirements

- **A DCI Should Be . . .**
  - **Flexible and Configurable** – Facilitates command and control of various systems and configurations across multiple sites
  - **Modular and Upgradeable** – Provides Plug and Play (PnP) support for a wide variety of components
  - **Accessible** – Utilizes current communications infrastructure and can be augmented with emerging technologies
  - **Based On Standards** – Utilizes common hardware and software standards
  - **Secure** – Provides for a wide variety of security needs
  - **Scalable** – Allows upgrades without changing the existing infrastructure

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DCI Requirements

- **A DCI Should Be . . .**
  - **Capable of Distributed Data Fusion –** Provide a high level intelligent view of the current situation for both local and remote users
  - **Cross-Domain** – Function as a part of existing military and commercial first response systems
  - **Able to Provide Workflows –** Facilitate workflows at both local and remote locations to provide intelligent automated decision support

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Why A DCI For Sensors?

IBAD

MICAD

JBPDS

ACADA

JSLNBCRS

??

JPS

BIDS

LR-BSDS

BAWS III / IV

BAWS 97/98

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Issues

- All of the sensor systems on the previous slide have different computer cores, communications technologies, operating systems, protocols, software and hardware support and logistics environments and requirements, but they DO NOT HAVE TO!!!
- Many of the previous systems have NO DATA SECURITY for secure data transmissions for wired and wireless environments – where they are present, only basic encryption and basic authentication schemes are used.
- Fallacy – “all sensors are different” - NOT with respect to the building block concepts I’m discussing, yet these components are still stumbling blocks with many sensor development programs.

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Issues

- **Joint Warning and Reporting Network (JWARN) exists – a testament to the issue and JWARN is only addressing a small subset of information assets and a small subset of a larger problem.**
- **Some programs are replicating user interface screens of other devices vs. dynamic creation.**
- **Many development efforts recreate components for:**
  - **Data Logging**
  - **Data Analysis**
  - **Communications / Networking**
  - **Device Drivers**
  - **Test Bed Analysis**
  - **Network Aggregation of Data**

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RECOMMENDATIONS

- Start now – performance based specifications are great but REQUIRE common proven building blocks that will allow the programs to focus on program specifics – this is not the road we are going down now and it is VERY EXPENSIVE in terms of cost, schedule, and technical robustness and lacks many lessons learned, where believe it or not, many programs expend the most time and effort.
- Make sure the performance specs focus more on common components so that we build in interoperability, standards, into the process up front (e.g. building codes). If you leave the entire implementation up to the contractor, there will likely be less motivation to produce an interoperable result.
- ***Require common computing building blocks even during the research and prototype phases – these systems end up evolving into fielded systems and if you don't require common building blocks at the beginning of the process you won't get them at the end.***

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RECOMMENDATIONS

- Require common building blocks for data processing, security, automation, and guidance and require the commonality at the meta-data “engine” layer so we can in fact establish building blocks.
- Consider the “fly-off” model for evaluation and downselect of technologies and then standardize on them once chosen. Spend a little more up front to save a lot in the long run.
- Get independent software and systems assessment as soon as possible and upfront to manage the selection of common components and insure that money is not being spent to reinvent the wheel.
- Once you establish these building blocks, you can truly take information management and decision aids and automated intelligence to the next level.

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Evolution of SensorView™

www.sensorview.com

- **JBPDS is the current state of the art in NB**
- **RTI was officially commended for outstanding performance as the software developer of the JBPDS (Ret.) (BG Eddie Cain and LTC Tim Moshier), JPO-BD**
  - **RTI developed 80,000 lines of mission critical software and embedded systems hardware for JBPDS over the course of five years**
  - **RTI provided wireless communications, sensor integration, networking and command and control for the JBPDS**
- **RTI has leveraged its NBC systems expertise and the core proven technology from JBPDS to create SensorView, which is proven, available, and on GSA Schedule.**

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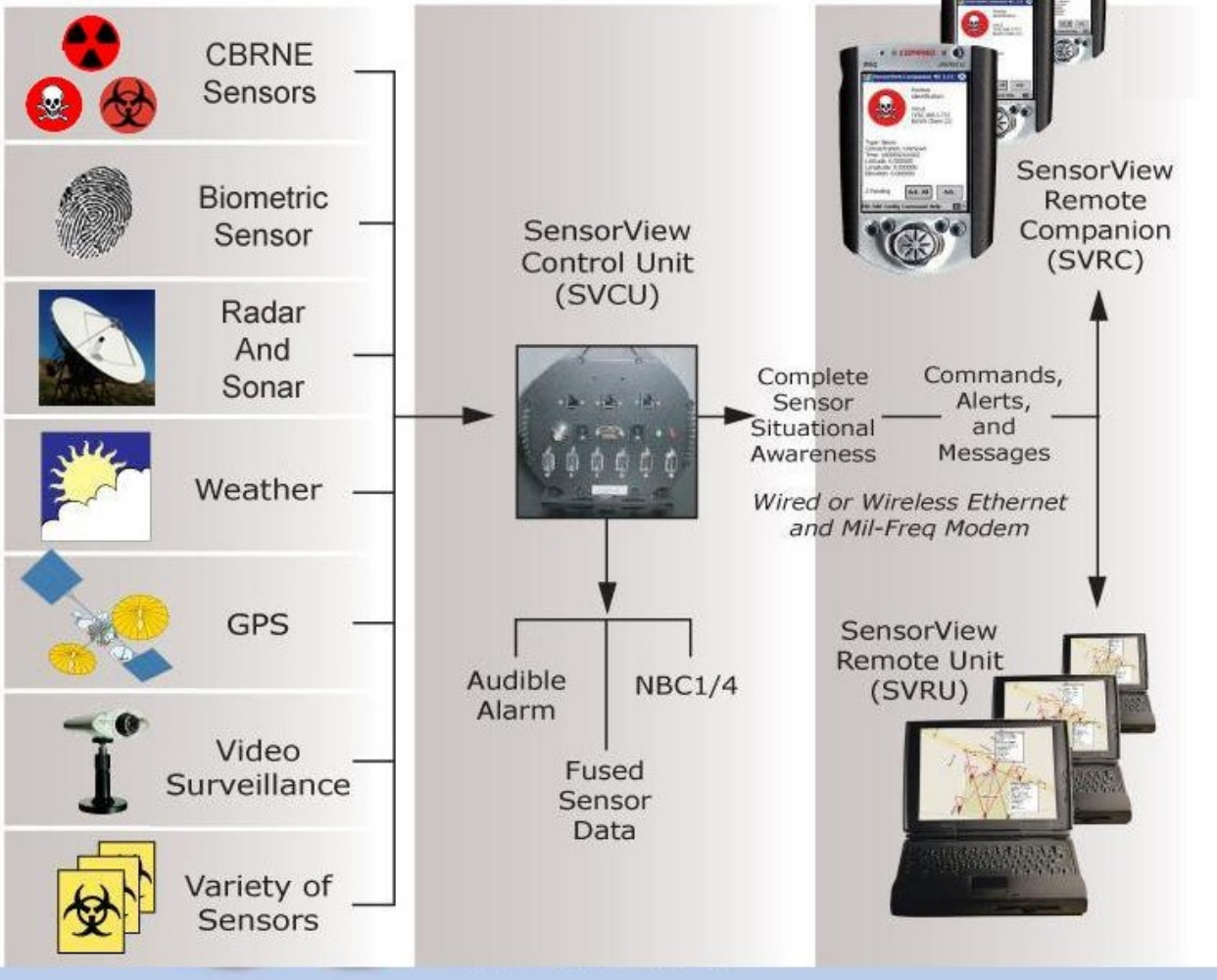
SensorView™ – What is it?

A Standard Platform for Command, Control, Monitoring, and Management of Heterogeneous Distributed Sensors



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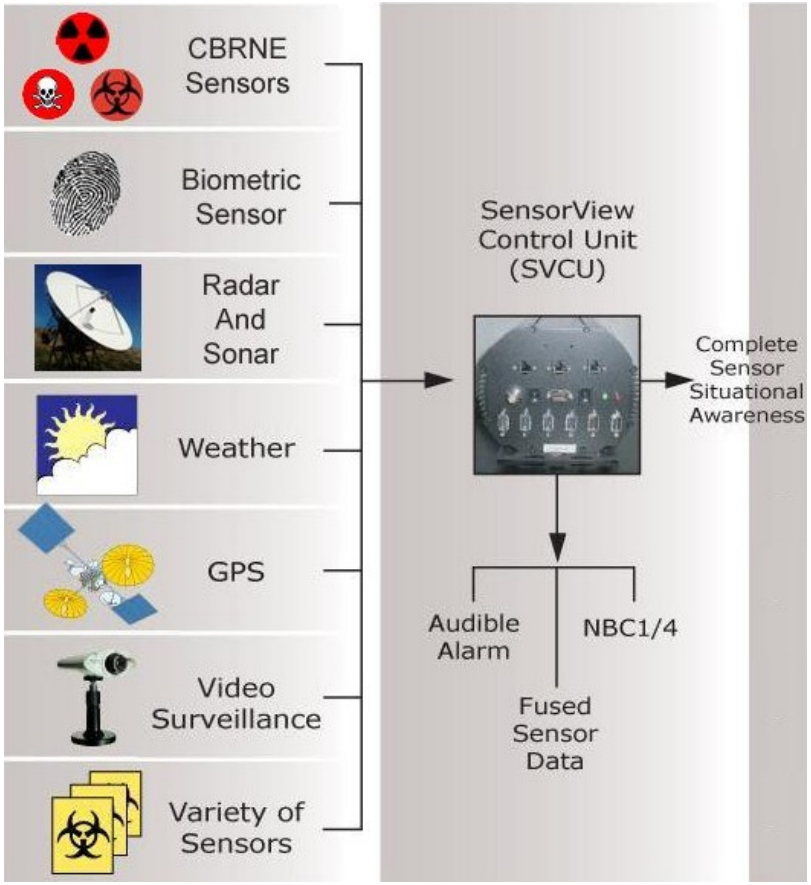
SensorView™ Control Unit (SVCU)



- Secure and encrypted (N-Bit Key, SSL, VPN) wireless Ethernet, wired Ethernet, Fiber Optic, or radio modem (Skyline or Freewave) communications link
- Repeater options allow each SVCU to act as a repeater and sensor platform simultaneously
- Audible alarm (remotely or locally controlled – M42A)
- Sensor integration platform that supports multiple RS-232, -422, -485, Ethernet, and A2D/discrete (+/-) interface based sensors with a generic sensor class/type command and control interface specification
- COTS parts that are readily available with no end of life issue for several years and multiple vendors
- 110AC or DC (Battery) Power
- Built In Test (BIT) and Degraded Modes of Operation
- Connects to individual sensors or networks of sensors
- Secure and web-accessible with an XML interface
- Hosted on ruggedized hardware or indoor PC
- Already designed for mounting on wall, pole, vehicle, portable tripod, or four point raised legs
- Meteorological (Weather) Sensor Interface
- GPS Interface including internal, PLGR, and NAVSTAR
- Over/Under Temperature Sensing and Reporting
- Universal Power Supply (UPS) Monitoring Interface

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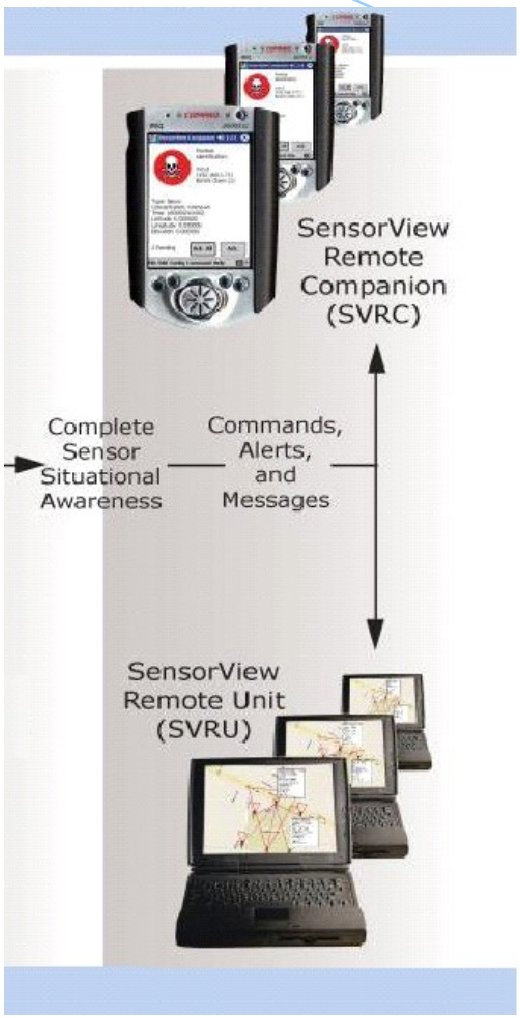
SensorView™

Remote Companion (SVRC)



SensorView™

Remote Unit (SVRU)

www.sensorview.com

- Situational awareness topographical mapping of sensors and sensor status
- Allows connection to and control of both individual sensors and sensor networks, which can be deployed in one location or a wide area (city / battlefield)
- Operators can receive data as well as send commands and alerts
- Networked aggregation of sensor data
- Effects (Plume / Wind) modeling capable
- Generates NBC1&4 Messages, Interfaces to FBCB2/Appliqué, and Proxy Server Framework in place on SVRU to support JWARN Interface
- Tactical Nighttime vs. Day color schemes
- Four-tier alarm and diagnostic capability for chem/bio/nuclear reporting, critical and non-critical failures, and advisory information alerts
- Intuitive and easy to use interface has been through two successful acceptance tests to all four military

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BENEFITS

- **User interfaces that are intuitive and easy to use and common**
- **Streamlines procurement and decreases cost**
- **Streamlines logistics through commonality of components**
- **Streamlines maintainability by having a common technology base and support environment**
- **Increases competition for better standard components which will yield innovation and lower cost and higher availability from industry (just like with personal computers and their peripherals… the same path, we believe, should occur for sensors and intelligent systems)**
- **Ultimately allows the war fighter to realize the benefits of interoperable network-centric devices – there's no silver bullet – you have to start with the foundation.**

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Focus on the Mission

- We should be focused on what to **DO** with the data.
- The common technology building blocks exist - make use of them.
- Too many people are still trying to reinvent the wheel due to lack of understanding or desire to maintain the size of their “rice bowl”.
- We cannot create the automated information management and decision aids for users if we do not build upon a foundation that we currently recreate and cannot progress beyond…

Final Thought: Imagine if every time you wanted to add an Ethernet card to a personal computer you had to hire a contractor and spend several hundred / thousand dollars because the Ethernet card, the software on it, and the hardware interfaces on your personal computer were not standard – that’s ludicrous, *right?* Well, this is exactly what has been happening and continues to happen with our sensor systems and programs that should be addressed to save money and to provide the needed interoperable and intelligent systems needed by the end user.

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Summary

- There is a Demonstrated Need for Requiring the Next Generation of Common Building Blocks for Digital Critical Infrastructure Components in Programs Sooner, Rather than Later

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